Treatment of Perforation.

	Cured.	Died.	Mortality percentage.
Suture	108	223	70.38
Enterostomy	9	11	55.00
Resection	0	3	100.00
Appendectomy	10	5	33.33
Total	127	242	65.58

Cases of Inflammation of the Appendix Submitted to Operation.

	Cured.	Died.	Mortality percentage.
Adults	10	3	23.07
Children	4	1	20.00
Not stated	4	0	00.00
Total	18	4	18.18

SPASM OF THE CHEST MUSCLES, PARTICULARLY THE INTERCOSTALS, AS A PHYSICAL SIGN OF DISEASE OF THE LUNGS.

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Muscle rigidity has long been considered an important symptom in certain diseases, especially acute disease of the abdominal organs. This muscular spasm or rigidity varies in location according to the organ diseased: thus, if the appendix is inflamed, the rigidity is found in the right lower quadrant of the abdomen; if the gall bladder, in the right rectus; if gastric perforation or pancreatic disease be present, in the upper portion of the left rectus; and when general peritonitis is present, the abdominal muscles generally show rigidity. Spasm of the lumbar muscles is noticed in pyelonephritis, and spasm of muscles about the joints is an important symptom accompanying tuberculosis of the joints. So far, I have not been able to find mention of rigidity of the chest muscles as a sign of inflammation of the lungs. Musser[1] mentions the fact that spasm of the thoracic muscles occurs over the affected side in pleuritis, but does not mention its occurrrence when the parenchyma of the lung is involved. Mackenzie[2] explains the sense of constriction experienced during attacks of angina pectoris as being due to spasm of the intercostal muscles through reflex stimulation.

In the examination of patients suffering from pulmonary tuberculosis, I have found this muscle rigidity, particularly as it affects the intercostal muscles, to be a constant sign. Not only have I been able to map out the areas of infection, but I have been able to judge the nature of infiltration with a considerable degree of accuracy by the condition of the muscles, the rigidity being much greater over dense infiltrations than over infiltrations of less degree, and greater over recent inflammatory infiltrations than over old quiescent ones.

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[1] Medical Diagnosis.

[2] Diseases of the Heart.

There is some question in my mind as to the exact explanation of these rigidities. It is easy enough to say that they are due to nerve irritation, but to trace accurately the paths through which the stimuli are conveyed is somewhat difficult; and the fact that the rigidity is so often confined to the muscles or even parts of muscles which immediately overlie the inflamed parts, seems to me to be unsatisfactorily explained by their nearness, and not explained at all by saying it is due to direct stimulation of the nerve trunks supplying the part, for other muscles or other parts of muscles supplied by the same nerve trunk as the muscle or portion of muscle which shows the rigidity, show none at all. A very good illustration of this is found in the rigidity in the upper portion of the left rectus in the presence of gastric perforation or acute pancreatitis. While the entire rectus is supplied by the lower intercostal nerves, the rigidity for the most part is confined to the upper portion of the muscle. It has been suggested that the areas showing greatest rigidity represent the fields of maximum response, but this fails to convey a clear, definite idea to the mind.

Neither can this be explained by the supposed and oft-repeated explanation of the rigidity of the abdominal muscles in the presence of acute inflammations of the abdominal organs: that it is Nature's method of protecting an inflamed part. This does not explain. It is simply a confession of ignorance in the guise of an explanation. It might be said with equal justice of the stiffness of an inflamed joint, and often is, that it is an illustration of the beneficence of Nature—that Nature has put the joint to rest in order to protect it; when the truth of the matter is that the stiffness is due to the products of inflammation being thrown out around and into the joint, and that it is an unavoidable condition without any respect whatever for the patient's welfare. In diseases of the chest such a supposed explanation falls of its own account; for what extra protection could the intercostals and other chest muscles give to the inflamed organs in the thorax over and above that furnished by the bony cage in which they are placed? It seems more probable that there is some direct nerve connection, perhaps of developmental origin, between the underlying organs and the special branch of the nerve which supplies the muscles overlying them, whereby impulses may travel without stimulating other muscles supplied by the same general nerve trunk. If this be true, we can see that while all the abdominal muscles are supplied by the lower intercostal nerves, and all the abdominal viscera are supplied by the sympathetic system, yet an appendicitis can stimulate the muscles in the lower right quadrant of the abdomen, and pancreatitis the upper half of the left rectus, without stimulating the abdominal muscles in general, and an inflamed area in the lung or pleura might cause a spasm of the overlying muscles without stimulating all the muscles supplied by the same nerve trunk.

It may be argued that the rigidity of the intercostal muscles that I have in mind is the same as has been described heretofore as due to pleuritis; but there are certain facts which speak against this. There is a rigidity that can be noticed over pleuritis, but it differs in degree from that noted when there is inflammation of the parenchyma of the lung. In the latter instance there is a much greater resistance, the degree agreeing very accurately with the percussion findings. The analogy of the abdominal conditions, which are accompanied by muscle rigidity, also speaks against the involvement of the underlying pleura as a necessary cause of the rigidity. In appendicitis the rigidity of the abdominal muscles is present when the inflammation is confined to the organ itself and the parietal peritoneum is free from disease. The same is true in gall-bladder disease and pancreatitis; so that it seems that inflammation of a contiguous part is not necessary to produce these muscular spasms.

The intercostal rigidity must not be confused with the feeling of resistance found over non-air-containing organs like the liver and heart. These organs can be outlined with more or less accuracy by palpating the intercostal spaces, but the sense conveyed to the touch over the heart or liver is very different from that experienced on palpating the rigid intercostals over pulmonary infiltrations.

That this is a true muscle spasm, and not dependent upon the thickness of the muscles themselves, can be easily determined by careful observation: if when examining a patient with pulmonary tuberculosis the examiner will carefully palpate the intercostal spaces, he will notice different degrees of rigidity over different areas of lung tissue; but allowing for the different thickness of the muscles and overlying tissues, it is still evident that the difference noticed by the touch is due to the condition of the muscles themselves and not to the thickness of the tissues.

While rigidity affects all the muscles of the chest, yet it is found in greatest degree in the intercostals. Rigidity in the superficial muscles may be detected by picking them up and rolling them between the thumb and fingers, when it shows as an increased firmness. In some instances the rigidity is so marked that it can be easily detected by the sense of firmness to the touch as compared with the softness of the muscles over healthy tissues. While the rigidity of the superficial muscles is at times very marked, yet I have found that of the intercostals of greatest value in diagnosis, except at the apices where the mass of muscles covering the superior aperture of the thorax may be relied upon.

In some instances not only are the motor nerves affected, but the sensory nerves also, in which cases the overlying skin is hypersensitive. Patients so affected often complain of pain when the skin is touched, and they are especially sensitive to the percussion strokes. This is often considered a nervous manifestation and ignored, but we have every reason to believe that it is painful.

What has seemed to me to be the best method of detecting the intercostal rigidity is a systematic palpation of the intercostal spaces, beginning at the lowest and comparing the rigidity of each space with the one above and also with the corresponding space on the other side. A little practice will soon show the examiner that he must allow something for the natural increased resistance over the heart and liver and also over thick muscles, such as the pectorals. The palpation is best done by gently pressing the tips of the fingers into the intercostal spaces and moving the hand sidewise while noting the degree of resistance. During this procedure the fingers should not be allowed to slip on the skin, for it is the condition of the muscle and not of the skin that is to be noted.

In examining many advanced cases of pulmonary tuberculosis, I have found that when the tissues break down and form a superficial cavity the resistance which was formerly noted disappears. I cannot believe that this indicates that the muscle rigidity has disappeared, for I believe this is more or less permanent. The explanation which seems to me probable is that the disappearance of resistance is due to the removal of the densely infiltrated tissues which have previously furnished support for the intercostals. That it is not due to a disappearance of the muscular spasm is supported by the fact that the rigidity does not disappear (at least not always) in old lesions, as, for example, in the instance mentioned later, in which the rigidity was found twenty-four years after the history of acute symptoms.

Not only does this spasm of the chest muscles bid fair to be an important physical sign in itself, but it helps to explain other well-recognized signs: lagging on the affected side, contraction of the chest wall, ankylosis of the costosternal articulation, diminution of the respiratory murmur, and the harsh, impaired respiratory note. It is obvious that spasm of the chest muscles must interfere with the free movement of the ribs, thus limiting the motion on the affected side and interfering with the normal expansion of the lung. We have been of the opinion that lagging is due to an interference with the normal elasticity of the lung tissue, owing to the presence of tubercles; but it seems that this muscular spasm adds another important and perhaps even greater factor. The connection between lagging and muscular spasm raises the question of the earliness in the disease in which this sign appears. Lagging is one of the most constant as well as one of the earliest signs noted in pulmonary tuberculosis. It is found before the presence of rales, when the only changes found upon auscultation are so slight that they can be detected only by the most careful examination; and it remains throughout the disease. So far I have been able to detect muscle rigidity above the clavicle and spine of the scapula, or in the first intercostal space in every early case that I have examined. While the number is too small to warrant a general conclusion, yet this indicates that the sign comes very early in the disease, and, of course, this is what we should expect. It is much more difficult to detect in these slight infections, and requires more skill and more care on the part of the examiner. How long it persists after activity ceases remains to be determined. Recently I had an opportunity to examine a man who had not had any active symptoms in the lung, as far as could be determined from his history, for twenty-four years, but I was able to outline his former trouble by the rigidity of the intercostals. Very marked lagging was present over the area which had been diseased. Percussion and auscultation proved the accuracy of the findings on palpation. While more observations are desirable before giving an opinion, this indicates that the sign is not an indication of active disease, but that it points to the fact that the underlying tissues are or have been diseased. While the intercostal muscles are not very large, and while their contractile power is not very great, yet it is evident that their constant contraction, reinforced by the less degree of contraction of the more superficial chest muscles, must have a tendency to lessen the thoracic space, thus causing the contraction or flattening which is so common in chronic pulmonary conditions. This same interference with motion of the ribs hinders expansion of the lungs and helps cause the auscultatory phenomena mentioned above.

The fact that this rigidity remains so long and is so constant needs explanation. It is contrary to the teachings of physiology that a muscle should remain in a constant state of contraction; sooner or later the contractile power is overcome, and relaxation ensues. That this does not occur in old lesions indicates that there is probably some pathological change, perhaps a fibrous degeneration which takes place in the muscles which preserves their rigidity.

A new physical sign is of no special importance beyond the scientific interest attached to it, unless it is a distinct aid to diagnosis. This, I believe, intercostal rigidity to be. Modern advances in diagnosis of diseases of the chest have had a tendency to belittle the value of physical examination. So many men had realized the difficulty of making accurate diagnoses by the usual physical examinations that when the microscope proved its value in diagnosticating tuberculosis they ceased making careful physical examinations and depended almost entirely on the microscopic findings. The tuberculin test as administered today hypodermically, by the skin and conjunctiva, will have a tendency further to discourage careful physical examination. This is greatly to be deplored, for approximately accurate diagnoses of pulmonary conditions can be made only after careful physical examination.

I hope that this sign may be of value, but I would add one word of caution as to technique: that is, not to lay the fingers flat on the chest, but to palpate with the ends of the fingers gently pressed into the intercostal spaces. The examiner will often be confused when pleuritis exists, for, as mentioned above, pleuritis produces a rigidity, but this can be excluded by other methods. It will also be difficult to interpret at times in chests which have been the seat of many and varied changes, such as we find in far advanced tuberculosis. But in these instances it is not different from other methods of physical examination, for they all fail us under such conditions. A little experience will show one its worth and also its limitations.

GASTRIC DIGESTION IN INFANTS.

A REVIEW OF THE LITERATURE.

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The investigations into the chemical and physiological processes which go on in the stomach of the human infant during the progress of digestion, may be divided chronologically into two groups: investigations before and after the introduction of the stomach tube. The studies of the first period were few and of but little value; they consisted in investigations on the lower animals and upon the cadaver of the human infant. The objections to the first of these methods depend upon the facts that at birth the digestion of the lower animal is in a more advanced state of maturity than is the case in the human being, and develops much more rapidly to the adult type, so that one is not justified in drawing absolute conclusions from animal experiments. The study of the stomach and gastric contents of the dead baby are open to the fallacies that whatever causes the death may markedly alter the constitution of the gastric juice, the condition being rather pathological than physiological, and that the gastric mucous membrane degenerates so rapidly after life has ceased that the state at autopsy may be markedly different from that occurring during life. However, one or two observations were made during this period which are of some interest, the most important being the finding by Zweifel,[1] in 1874,

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[1] Untersuchen über den Verdauungsapparat der Neugeboren, 1874.